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Belaire Elementary School, San Angelo, Texas. Profiles of Significant Schools.

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A profile is presented of a circular, air conditioned elementary school designed to be adaptable to almost any kind of educational program--its space can be rearranged by means of movable and operable walls to meet changes in the existing program or to accommodate the school to future programs involving classes of varying sizes. The description emphasizes why the school was designed as it was and how it was designed and built. Schematics and photographs are included along with an evaluation of the school. (FS)

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Profiles of Significant Schools

B E L A I R E E L E M E N T A R Y S C H O O L

S A N A N G E L O , T E X A S

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New Ideas for School Design

Communities all over the United States are building new schools. But not every administrator, architect, and school board member can tour the country looking at the latest developments in school planning and design.

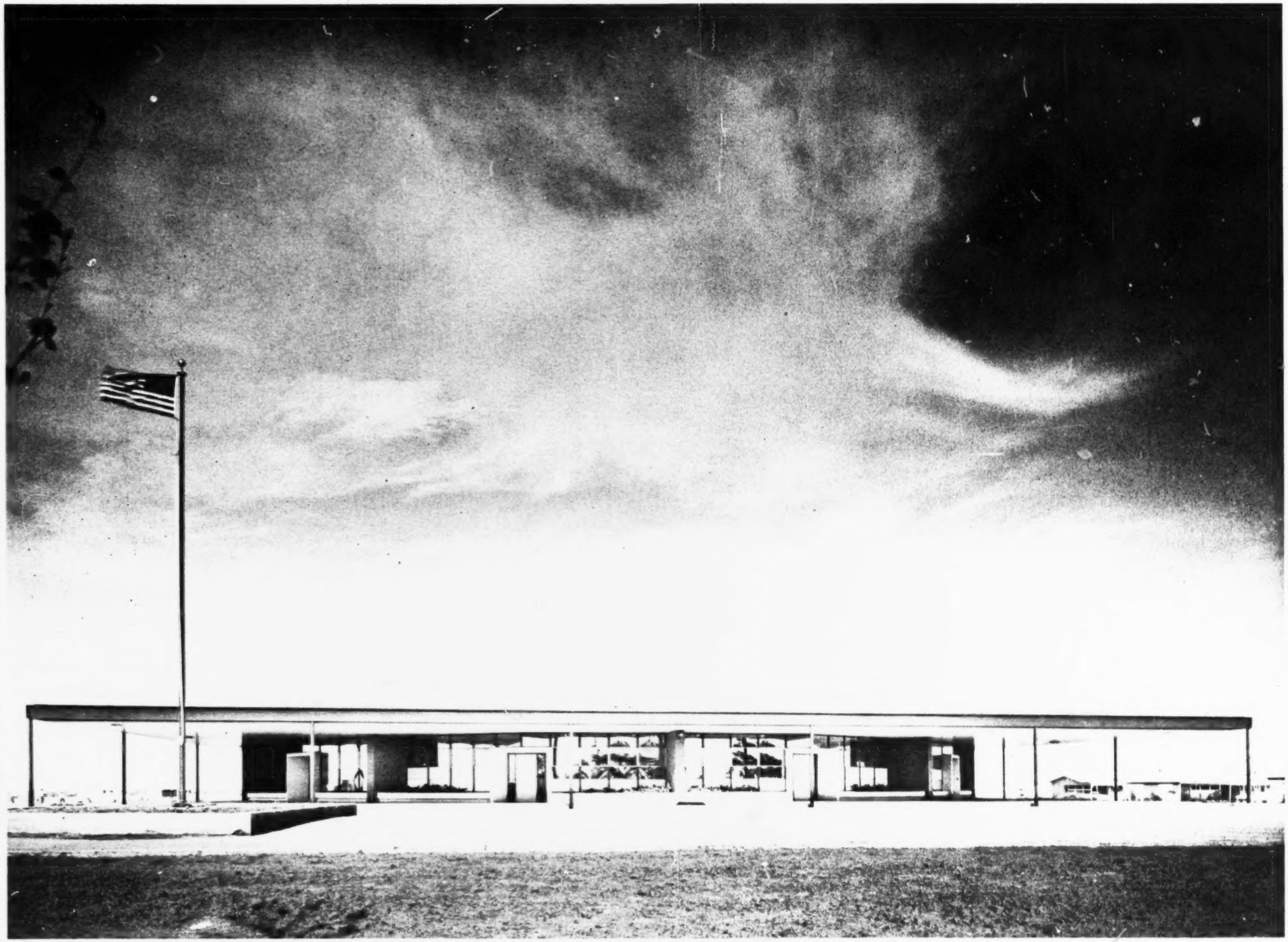
To provide people engaged in school building with a detailed knowledge of the most adventurous new schools, EFL is publishing this series of reports, entitled Profiles of Significant Schools. The reports attempt to show two things: why the school was designed as it was, and how it was designed and built. In order to do this, the Profiles will explore the educational program (which may in itself be unusual), any architectural innovations the design may contain, and any special features that may be of interest, such as air conditioning, flexibility, or open planning.

These are Profiles of individual schools, built in individual communities, to house individual programs. These schools will not necessarily serve ideally in other communities, but many of the ideas incorporated in them are applicable in many places. We hope that people involved in school planning and building will find the ideas stimulating and useful.

We would appreciate your reactions to the series as well as suggestions for making future Profiles more useful.

School:	Belaire Elementary School San Angelo, Texas
Capacity:	240 students
Grades:	1 - 6
Opened:	January, 1956
Superintendent:	G. B. Wadzeck
Principal:	Harvey Palmer
Architects:	Caudill, Rowlett & Scott Texas, Oklahoma, Connecticut Donald R. Goss Associated Architect San Angelo, Texas

San Angelo, Texas, a city of 70,000, is one of the main retail, wholesale, and banking centers for western Texas. Residents are employed chiefly in trade, manufacturing, and ranching. Population has tripled since 1940, in part because of a military installation - Goodfellow Air Force Base - just outside the town. This growth has required an extensive school building program.



Belaire Elementary School, San Angelo, Texas

Of all the elementary schools built in this country during the past decade, Belaire Elementary School in San Angelo, Texas, remains one of the most remarkable and imaginative.

It was the first circular, air conditioned school. It was designed to be adaptable to almost any kind of educational program. It is an extraordinarily efficient school - most of its space is in use during most of the school day and all of its space is usable all year. This space can be rearranged by means of movable and operable walls to meet changes in the existing program or to accommodate the school to future programs involving classes of varying sizes.

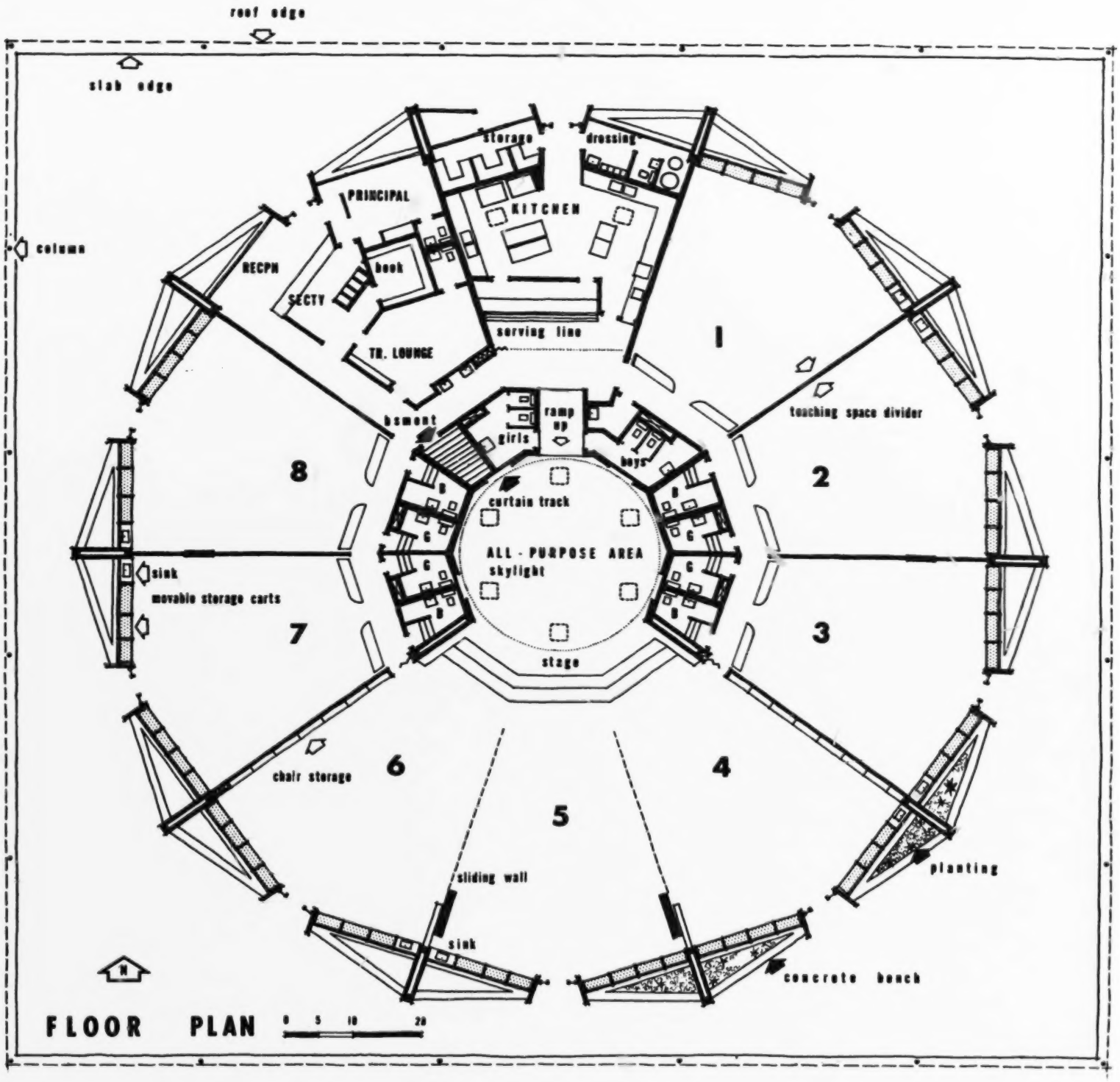
All of these educational advantages were obtained at Belaire without excessive cost. Belaire, in fact, has turned out to be an unusually economical school, producing unexpected savings, especially in matters of maintenance.

How Belaire Got That Way

Belaire is situated on a completely flat piece of land in the northern section of San Angelo. The climate in this part of Texas is warm, dry, and dusty. During the first and last six weeks of the conventional school year, conditions inside a school can be quite uncomfortable. Teachers report that the children get "pretty dehydrated" by noon and tend to sit and watch the clock rather than learn. During the summer months - San Angelo is contemplating a longer school year - the climate makes a building without air conditioning virtually useless as a school. Thus air conditioning at Belaire was installed not merely for comfort but to make the school more educationally efficient.

Belaire, however, was hermetically sealed and air conditioned not only because of climate but also because of noise. The school lies close to the end of the main runway at Goodfellow Air Force Base (many of the students come from Air Force families living near the field). The first design attempts to overcome this noise problem - such as covering the school with a second, umbrella-like roof - proved unworkable and almost as costly as air conditioning. The architects and the school board decided that closing up the building and providing air conditioning was not only desirable but was also the most

Belaire - 2



Belaire is technically not a circular but a decagonal - or ten-sided - school. It contains eight classrooms, each designed to hold 30 children.

practical solution to all of the environmental and educational challenges posed by the school's location.

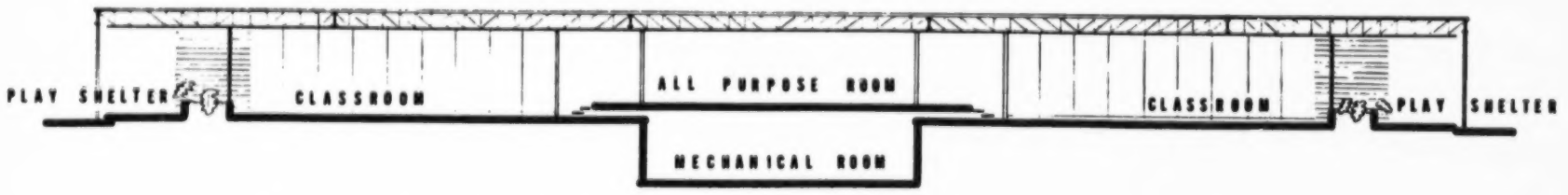
A second challenge that shaped Belaire's design was purely educational - the need for a school that could adapt to program changes from hour to hour and year to year.

To the school board, the superintendent, and the architects, this kind of adaptability meant a schoolhouse with the smallest possible number of permanent interior walls, a building that could be rearranged if the educational program demanded a different kind of space. Adaptability also meant a school with spaces that would efficiently serve a number of different purposes. There should be few, if any, spaces which were unused for long periods during the day.

These various educational aims suggested to the school's planners a building with as few load-bearing walls as possible. Every non-load-bearing partition would be either operable at will or easily removable.

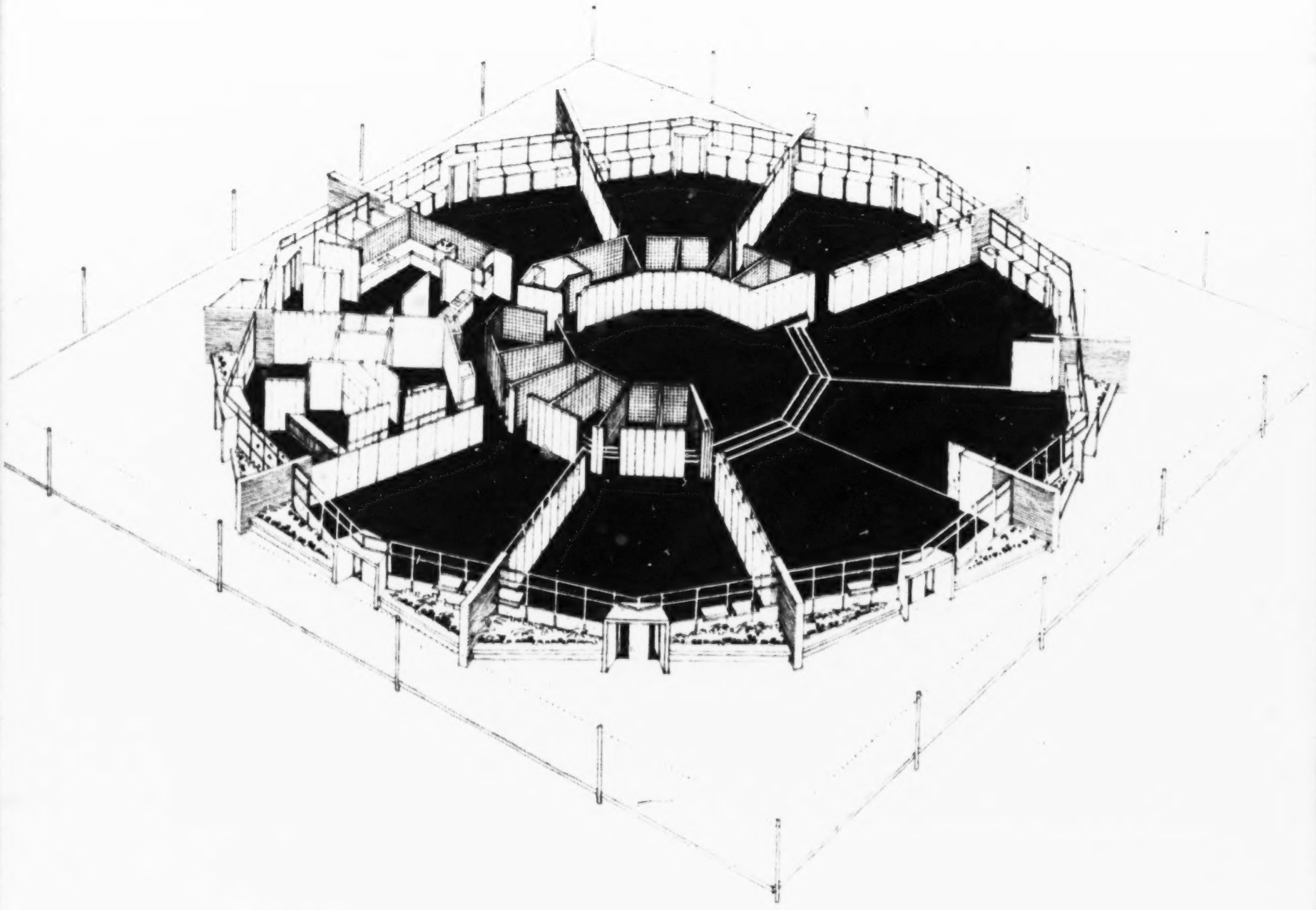
The Results

The decision to air condition Belaire as economically as possible suggested the final shape of the building - a basically circular form with the mechanical facilities in the center. A circular form uses the least perimeter to enclose a given amount of space. In the case of Belaire, this minimized the wall area exposed to the Texas heat. Therefore, less air conditioning equipment was needed. Because the refrigeration equipment is located at the center of the building, rooms are serviced by short, and therefore less costly ducts. Since the equipment is dropped into a basement, it does not take up educationally usable space. Plumbing facilities are also located in the mechanical basement.



The mechanical facilities at Belaire are placed in a basement beneath the center of the school.

The slightly raised platform over the mechanical basement is used as a central multipurpose area that is the core of the school. The wedge-shaped classrooms and service rooms radiate from this core.



Belaire is a compact, circular school built around a central all-purpose room.

Classrooms

Belaire is cut into 10 identical pieces. Eight pieces are classrooms, one is devoted to office space, storage, and a teacher's lounge, and the last houses kitchen facilities.

Each of the classrooms contains 1,150 square feet of space including corridor area, and is designed for 30 children. Five of the classrooms are separated by partitions which are 4 foot by 8 foot panels framed on wood studs covered by ¼ inch plywood. The plywood is in turn covered by chalkboard, tackboard, or pegboard. These panels extend to about 12 inches below the ceiling. The remaining area is glass paneled to allow light to pass from classroom to classroom, giving a greater flow of space to the school's interior.

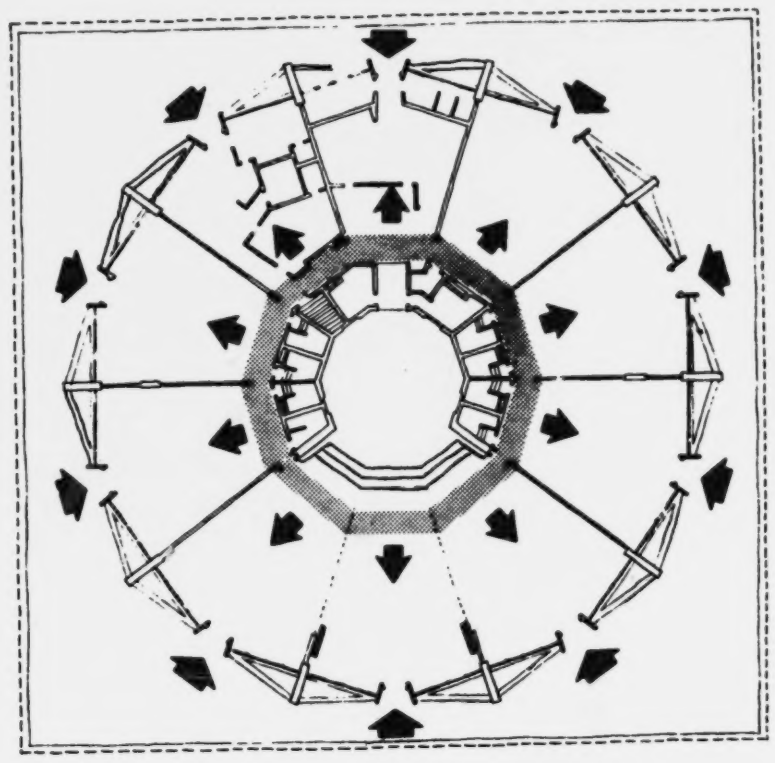
A typical Belaire classroom, looking towards the central core. The air conditioning ducts are located above the entrance way.

Along the perimeter of the building a typical Belaire classroom has a broad window wall looking out under the shading overhang of the roof. Along the bottom of the exterior wall, are movable cabinets which provide space for the storage of play and art materials, coats, and teacher's materials. There is also a sink and a portable library cabinet.

The window wall of a typical Belaire classroom is shaded by the extended overhangs of the roof.

Each Belaire classroom has a door to the outside. None has an interior door. According to the original design, the school was to have no corridors - the core end of each classroom was left open for traffic.

Each room at Belaire has an outside door and is served by the central circulation space around the core.



This arrangement had drawbacks. The teachers did not feel comfortable with so open a plan. They complained about people walking through their classrooms and about noise from the neighboring rooms.

To handle the teachers' objections, the architects designed a system of movable storage cabinets placed between the corridor area and the rest of the classroom. Acoustical tile panels extending almost to the ceiling were placed on top of the cabinets (see picture, page 5). This device effectively screened off the classroom from passers-by.

On the core side of the corridor area, each of five regular classrooms has two washrooms. These washrooms are located close to the central basement making possible short, and economical, plumbing runs.

The All-purpose Area

The raised platform in the center of the school and the three special classrooms connected with it form Belaire's large, all-purpose area.

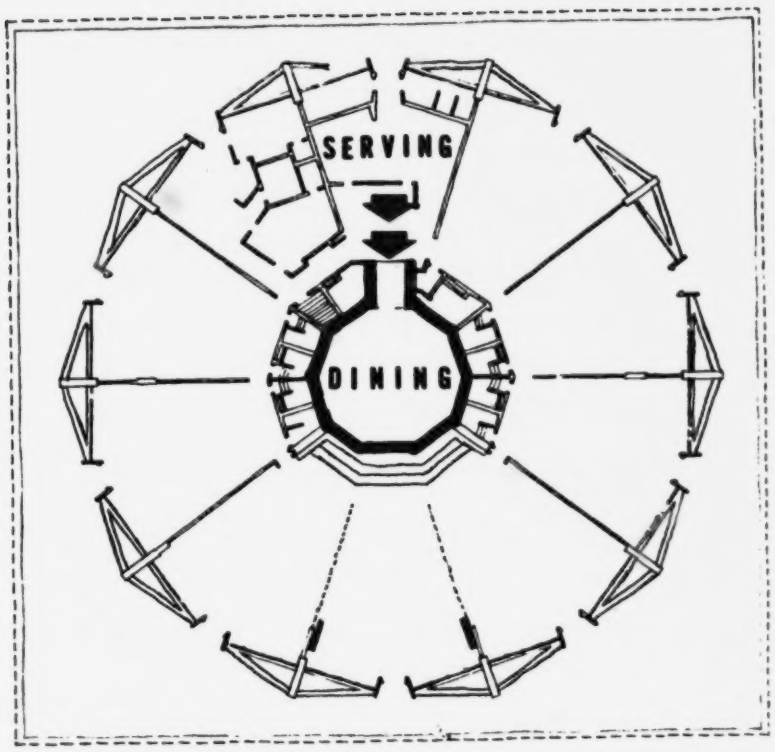
The circular platform section is surrounded by solid walls except for the area adjacent to the three assembly classrooms and the passage ramp leading to the kitchen. These open spaces can be closed off with curtains that serve as visual but not acoustical barriers.

The platform alone serves mainly as a cafeteria and as an audio-visual room. It can also be used for theatrical rehearsals.

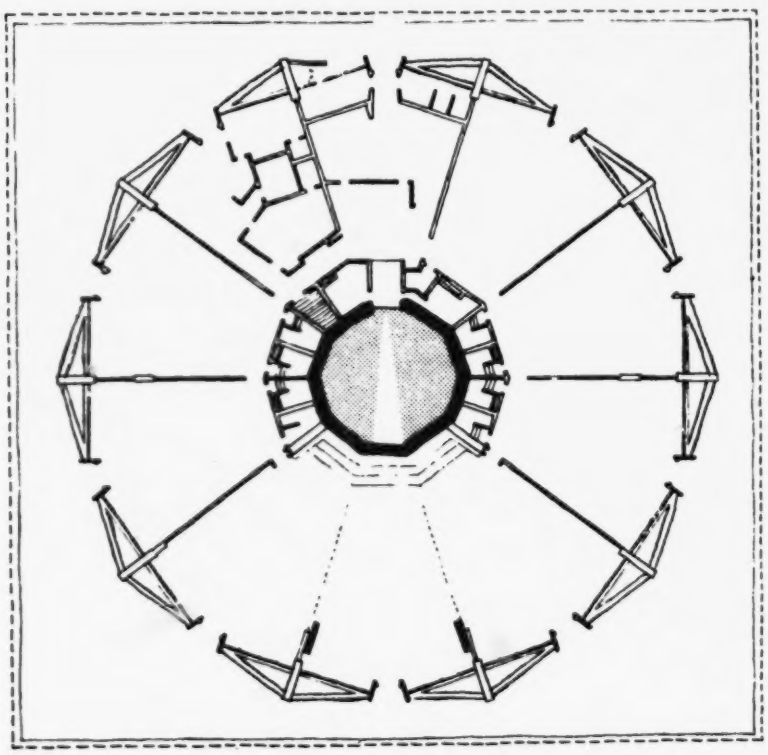
When the platform is being used as a cafeteria, tables and chairs are taken from storage spaces in the walls behind the curtains and set up on the platform. Natural light comes from six skylights set in the roof.

For dining, the central platform is filled with chairs and tables.

The children and teachers form a line passing the kitchen, get their food, and carry it to the tables on the platform.



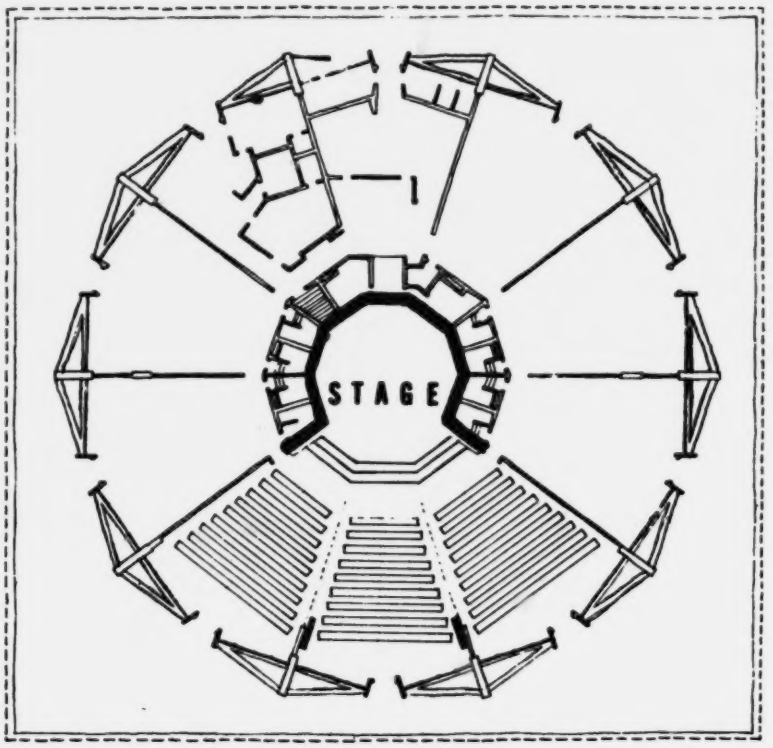
When the platform is being used as an audio-visual room, the curtains are pulled around to close off the area, and shades are drawn over the skylights.



With the curtains pulled, the platform becomes an audio-visual room.

When the three classrooms operate as part of the central all-purpose area, the platform becomes a stage. The curtains are then used as conventional theatrical curtains.

With the conversion of the three adjacent classrooms into seating space, the all-purpose area becomes a theater-auditorium.



During most of the school day, the three classrooms operate as individual classrooms with the operable walls closed and the stage curtains drawn. Auditorium seats are stored in the partitions which separate these classrooms from the others. These rooms are transformed into a seating area for the stage by sliding back the operable walls. Classroom desks and chairs are moved to one side, and auditorium chairs set up.

The three classrooms with operable walls can also be used together for an educational program that varies the size of the classes. But this has not yet been attempted at Belaire.

With the operable walls moved back and the chairs set up, the classrooms and the platform are transformed into an auditorium.

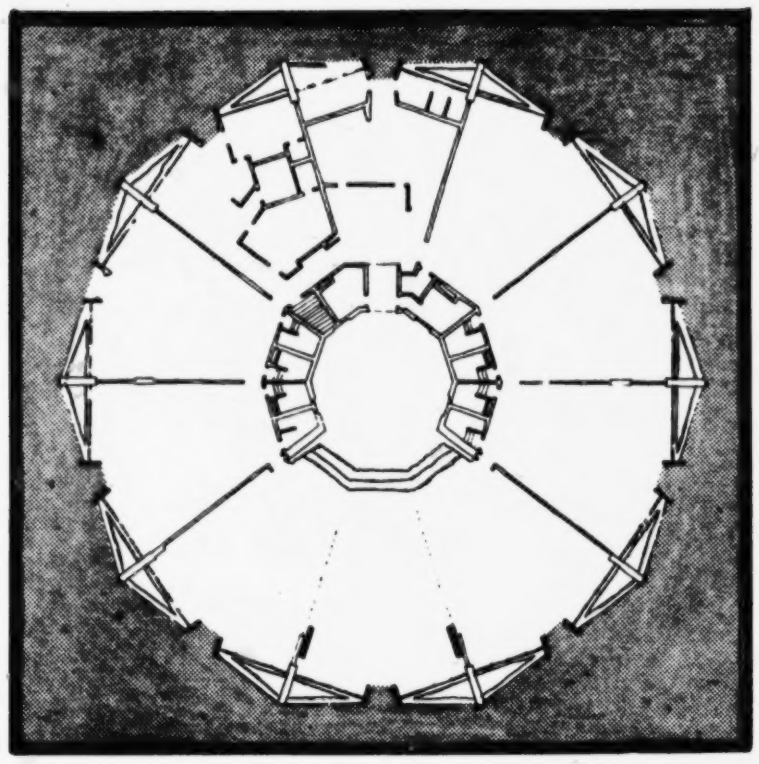
Outdoor Space

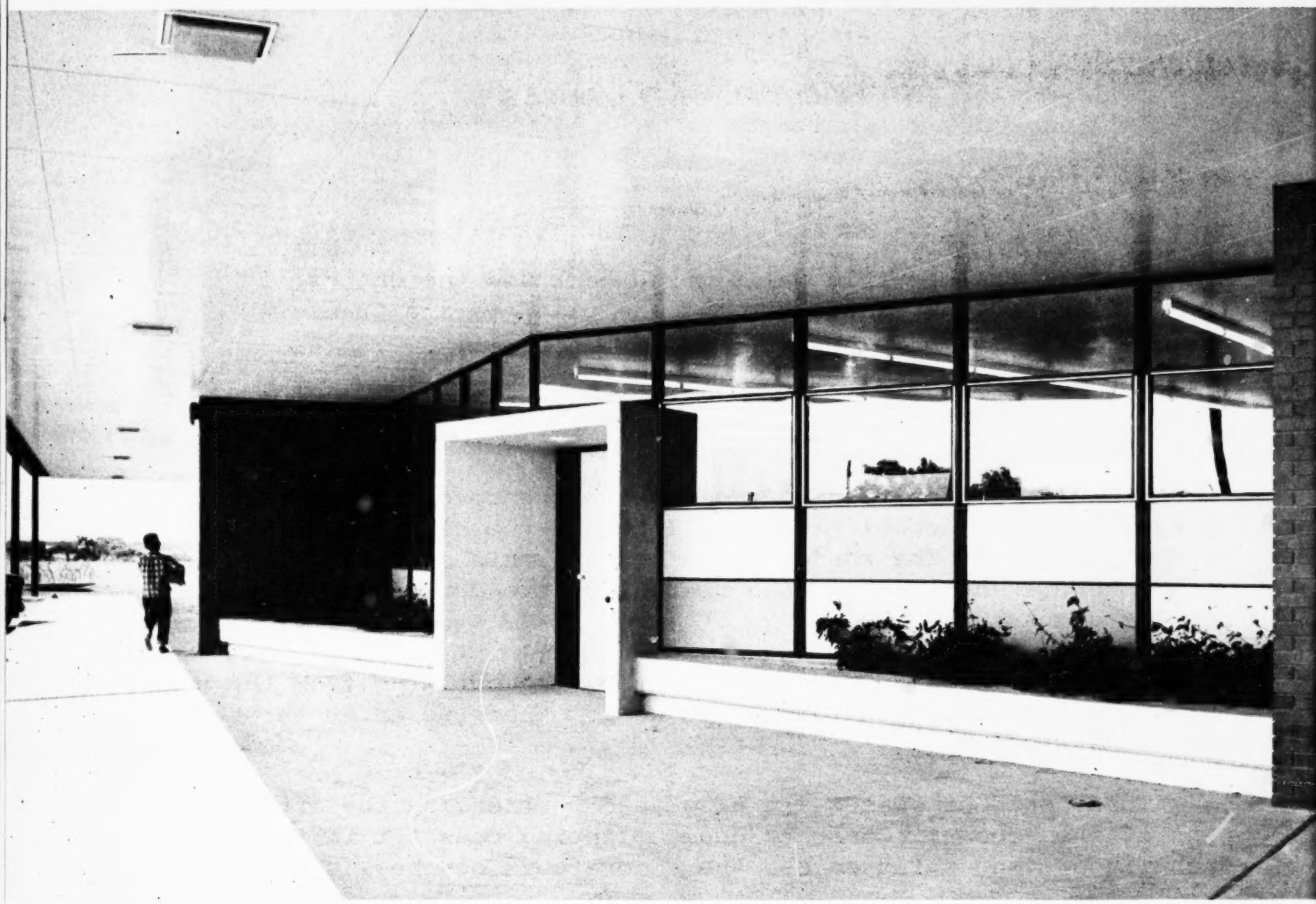
A basic part of Belaire's design is the covered space created by extending the school's roof well beyond the circular perimeter of the building. The shaded space beneath this overhang is paved with concrete and is used as a recreation area. There is no regular gymnasium.

The overhang also serves to protect the building from the heat and glare of direct sunlight which would otherwise enter through. the large windows.

These outdoor spaces are also used to increase the attractiveness of the school. Concrete edged planting beds sit in front of each window, and children use the concrete as benches.

The square roof provides large areas of shaded space.





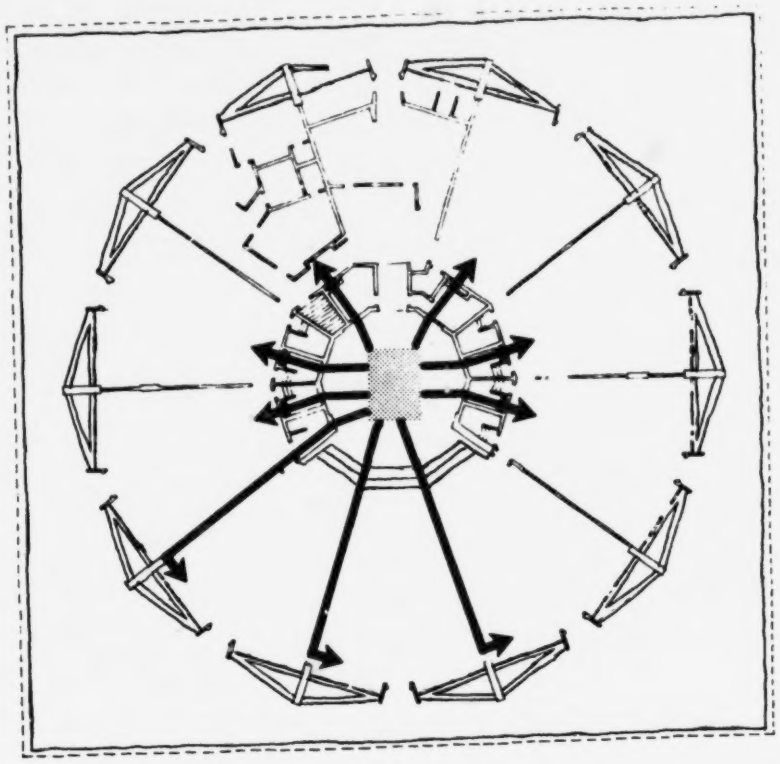
Belaire's shaded exterior is ornamented with plantings and brick piers.

Air Conditioning

The central mechanical core, containing the heating and cooling apparatus, provides each of Belaire's ten basic spaces with an individually zoned temperature. The general temperature level is established by setting a control in the principal's office (normally 76° F). Individual thermostats in each room supply warm air on cold days or cool air on hot days as each room needs it.

The heating or cooling is supplied by an air handler consisting of a fan, the refrigeration equipment for cooling, and a boiler for heating. The warm or cool air thus generated is carried to the individual rooms through ducts.

Warm and cool air is supplied to eight of the school's rooms through short - and therefore quite economical - ducts. The ducts supplying air to the three "assembly" classrooms are longer and are placed under the floor. The cooling tower is a forced draft type located on the roof above the central core.



According to the architects, the Belaire air conditioning system had a low initial cost ($495 per ton as opposed to an average of $660 for other installations in the area) and has a low upkeep. This economy stems from the compact design of the building. But it is also helped by the shading overhang which reduces the cooling load.

In addition to its initial cost advantages, the air conditioning at Belaire, according to records kept by the school over the

past several years, has lowered maintenance costs of this particular building by as much as $1,200 a year, compared to similar but non-air conditioned schools in San Angelo. The hermetic sealing of the building has kept out much of the dust that prevails around San Angelo. The school uses only one custodian instead of the normal two, and there has been a substantial saving on maintenance equipment. Since it costs Belaire an extra $500 a year to cool the building with air conditioning, this constitutes a saving of approximately $700 in the school's yearly operating costs. Over the years, this saving will go a long way towards paying back the $19,800 it cost to install Belaire's air conditioning.

Construction

The floors at Belaire are reinforced concrete slabs covered with asphalt tile. Exterior walls are brick piers or window walls of glass and asbestos cement board panels.

The roof is formed with long span steel bar joists, steel beams, and a steel roof deck. The entire roof structure is supported by steel pipe columns. The roof frame is decked over with 1 inch insulated board covered with built-up pitch and gravel.

Efficiency, Reservations, and Cost

In spite of its remarkable efficiency, Belaire is not as efficient as it could be. Sound transmission problems - between classrooms and between the central platform when it is curtained off and the assembly classrooms - place a limit on the amount of simultaneous activity that can go on in the school. Strategically arranged acoustical tile in the classrooms and sound-retardant operable walls around the stage would increase the efficiency of the building. But even as the school stands now, it provides more flexibility than the current program demands of it.

Belaire has no library and no gymnasium, and the building cannot be expanded. If it becomes necessary to house more children in the Belaire district, San Angelo will build a duplicate of this school nearby.

Even with these reservations, Belaire remains an efficient, adaptable - and quite economical - school. The fully air conditioned building cost San Angelo $191,122 including architect's fees, all mechanical facilities, kitchen equipment, and paving. This figure does not include stage equipment or movable furniture.

Belaire contains 13,650 square feet of enclosed educational space and 800 square feet of mechanical basement. In addition, there are 11,144 square feet of covered, paved, and unenclosed play area beneath the overhangs. Figured at one-half for cost purposes, this unenclosed area amounts to 5,572 square feet, giving a total of 20,022. Thus Belaire's cost per square foot is $9.55 and the cost per pupil at design capacity $796. The air conditioning facilities cost San Angelo $.99 per square foot.

Actual construction cost, excluding architect's fees and a minor change order, was $179,418. This gives a square foot figure of $8.96 and a per pupil cost at design capacity of $748.

COST BREAKDOWN

		Cost	Per Cent of Total *
SITE			
Site work (excavation & paving)		$ 2,900	2%
BUILDING SHELL			
Footings, foundation piers & floors (concrete, reinforcing steel & labor)		33,500	19%
Structural frame (steel)		22,365	12%
Roof deck & skylights		5,454	3%
Roofing & flashing		7,000	4%
Walls & partitions			
Masonry	$ 3,000		
Metal partitions (interior)	200		
Folding walls	8,208		
Glass, glazing, windows & exterior wall panels	5,695		
Weather stripping & rough carpentry	18,014		
		35,117	20%
FINISHING & EQUIPMENT			
Interior finishing (tile, painting millwork & hardware)		17,200	10%
Plumbing, heating, ventilating, & cooling		31,222	17%
Electrical wiring & fixtures		9,525	5%
Miscellaneous equipment		12,135	7%
OVERHEAD			
Contractor's job overhead (bond & insurance)		3,000	2%
Total Cost		$ 179,418	

* Because these figures are rounded off to the nearest whole per cent, they do not add up to 100 per cent.

AREA BREAKDOWN

			Square Feet	Square Feet Per Pupil
EDUCATIONAL AREAS			8,461	35.25
AUXILIARY AREAS	Square Feet	Square Feet Per Pupil		
Cafeteria & Kitchen	796	3.32		
Administration	794	3.31		
Multipurpose Rooms	750	3.13	2,340	9.76
STRUCTURE & SERVICE			6,493	27.05
		TOTALS	17,294	72.06

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